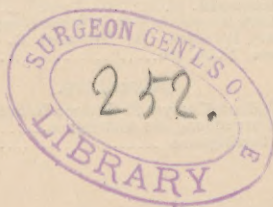


Robinson (A. R.) Comp. of the Author

The Anatomical Seat of  
the Fungus in Tinea  
Tonsurans Capillitii.

BY  
A. R. ROBINSON, M. D., ETC.

REPRINT FROM  
The New York Medical Journal.  
March, 1881.



This Paper is reprinted from THE NEW YORK MEDICAL JOURNAL for March, 1881.

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NEW YORK: D. APPLETON & CO., PUBLISHERS,

1, 3, & 5 BOND STREET.

SINGLE NUMBER, 40 CENTS.

YEARLY SUBSCRIPTION, \$4.00.



Dr. F. A. CASTLE.

## THE ANATOMICAL SEAT OF THE FUNGUS IN TINEA TONSURANS CAPILLITII.

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THE parasite present in tinea tonsurans capillitii is the vegetable fungus, trichophyton tonsurans. The form of eruption produced by the presence of this fungus in or upon the human skin depends upon the anatomical structure and upon the irritability of the histological elements of the affected part. The different forms of eruption have received different names, according to their form or anatomical seat; thus, we have tinea circinata (ringworm), tinea tonsurans capillitii, tinea tonsurans barbæ (sycosis parasitica), eeczema marginatum, and kerion; but it is to be remembered that it is the anatomical character of the affected part, and the irritability of its histological elements, that produce the different pathological conditions in the different cases.

The fungus consists of spores and mycelia. The slower the process of multiplication of the fungus, the greater is the number of spores present in proportion to the mycelia, and *vice versa*. As the eruption produced by the trichophyton tonsurans spreads peripherically, more mycelia in proportion to the spores are present at the circumference than at the center of the affected area. In tinea tonsurans capillitii I have always found a much greater number of

spores than mycelia present, but Kaposi ("Pathologie und Therapie der Hautkrankheiten," Wien, 1879, p. 736) has made the contrary observation.

The anatomical seat of the trichophyton tonsurans in tinea tonsurans capillitii is still a matter of dispute. According to Kaposi (*Ibid.*, p. 736), the fungus in tinea tonsurans vesiculosa, squamosa, and maculosa is found between the upper layers of the nucleated epidermis, directly beneath the corneous layer; and in tinea tonsurans capillitii it is present also in the hair and in the hair sheaths. Two drawings representing the fungus (rich in mycelia) accompany the text of Kaposi's article.

In the "Lancet" of March 30, 1878, p. 459, Dr. Thin, of London, gives an account of the appearances he observed in sections of the skin from a case of ringworm in a horse. He found the fungus present only among the most superficial scales of the corneous layer, and on the shaft of the hair, and between the shaft and the internal root sheath. It was never found in the root sheaths, in the root of the hair, nor in the hair papilla or in the surrounding connective tissue. "The affected hair first bends and then breaks at a point usually midway between the rete Malpighii and root of the hair, this bending and subsequent breaking being caused by the disintegrated hair yielding to the pressure produced by the normal growth of the shaft upward. Sometimes extensive changes were found in the cutis and rete Malpighii, but they did not differ from inflammation of these structures, however induced."

Shortly after Dr. Thin's report, Dr. F. Taylor, of London ("Lancet," Nov. 16, 1878), contributed a paper upon the subject, based upon the microscopical examination of a patch of tinea circinata. He found that in the early stage the hair retained its form, and had within it simply a varying number of mycelial threads running parallel to its length. In a later stage the hair is obscured by a crowd of spores closely packed in the follicle. "In a downward direction the fungus does not extend beyond the upper end of the hair bulb, and the papillæ are never invaded. Laterally the spread of the fungus is limited by the inner root sheath, with which in advanced stages the spores are in contact. The integrity of the sheath is maintained even when the follicle is choked with spores. The fungus is never found in the external root sheath, rete mucosum, corium, or subcutaneous tissue. The hairs were not broken or twisted."

According, therefore, to Dr. Thin and Dr. Taylor, the fungus is never present and actually can not exist among living animal tissues, but lives upon effete epidermic structures. Their observations were



made from sections of the affected skin, and can be considered reliable as regards the two individual cases examined; but the authors were hardly justified in forming from them definite conclusions as to the anatomical seat of the fungus in every case of the disease. Kaposi merely examined extracted hairs and detached epithelium from the corneous layer—a most imperfect mode of studying the situation of the fungus, as it only enables one to judge of the presence or absence of the fungus in a portion of the skin. If, however, Kaposi saw the fungus in the rete Malpighii (and his drawings represent it as very abundantly present), then the question as to its ability to exist in living tissues is settled. In *tinea tonsurans barbæ*, Lang ("Ueber eine seltener Form der parasitären Sykosis und einige entzündliche Geschwülste," "Viertelj. f. Derm. u. Syph.," 1878, p. 393) found the fungus, especially in recently affected hairs, in the hair shaft, hair root, and root sheaths. He examined only extracted hairs. In *kerion*, Majocchi ("Gazzetta Medica di Roma," No. 5, 1877) found the fungus within the hair follicle, along the hair shaft, and also in the connective tissue around the follicle.

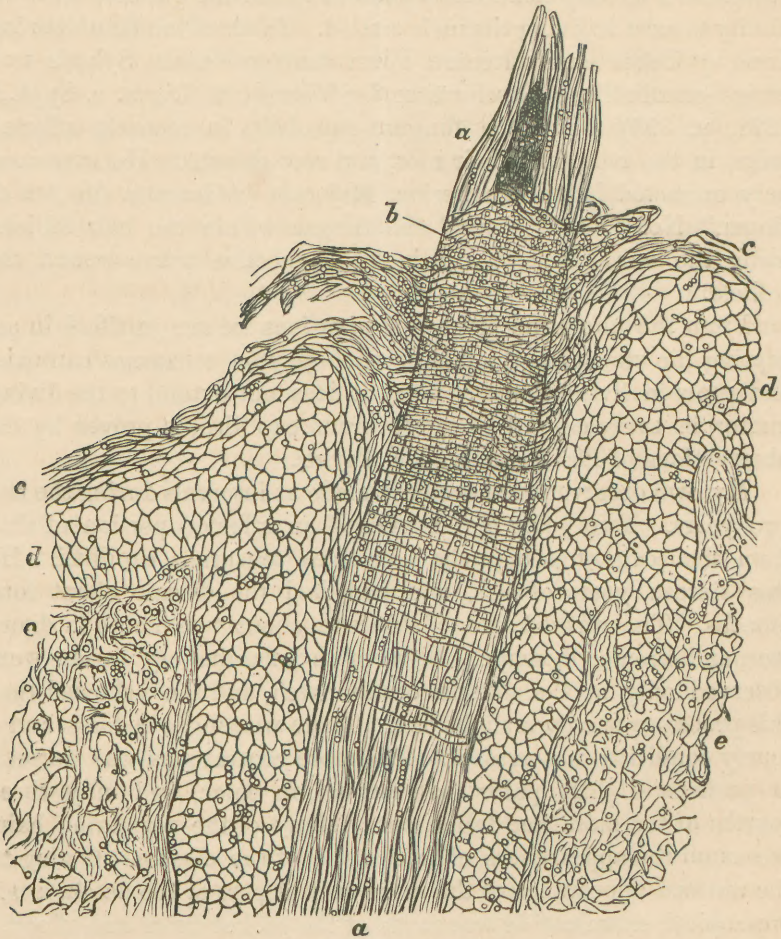
From the above-mentioned observations we are justified in accepting the view that the fungus *trichophyton tonsurans* can exist and grow in living tissues. That it does not extend to the living matter in every case of *tinea tonsurans capillitii*, is proven by the observations of Dr. Thin and Dr. Taylor.

My own observations have been made at intervals during the last two years. Two years ago I excised an affected portion of skin from the scalp of a boy who had *tinea tonsurans capillitii*. He was sixteen years of age, and had had the disease about four months. The affected area of skin was about two inches in diameter, and circular in shape. Signs of an inflammatory process were observed only at the margin of the patch, and these showed that this process was only a slight one. There was slight redness, and a scurfy condition was present. The more central part was normal, or perhaps slightly paler than normal, in color, and fully three fourths of the hairs had fallen out. Many of the remaining hairs presented the appearances characteristic of the disease. Owing to the unusual appearance of the more central part of the patch, a microscopical examination was made of the broken hairs and of some epidermic scales, and the diagnosis of *tinea tonsurans capillitii* was confirmed. A few applications of a six-per-cent. solution of oleate of mercury destroyed the fungus, and in two months the part was provided with normal hair. The excised portion of skin was taken from the margin of the patch, and included both normal and dis-



eased tissue, while in depth it extended to the periosteum. After removal it was washed with water, to remove any blood from the surface, then placed in Müller's liquid, and finally in absolute alcohol. The sections made were treated in many ways, some being examined in glycerine without previous staining, and others colored with carmine, hæmatoxylin, methyl-aniline, or iodine. Caustic potash in varying strength, the strongest solution containing one part of potash to eight parts of water, was generally made use of for fur-

FIG. 1.



*a*, hair shaft; *b*, internal root sheath; *c*, corneous layer; *d*, mucous layer; *e*, corium.

ther study of the sections. A few sections were boiled in ether, and others were treated with turpentine, nitric or acetic acids. The different manipulations were employed to aid in the study of the



sections, and to correct, if possible, errors of previous observation. Some of the specimens drawn (Figs. 1 and 2) were shown to Dr. W. H. Porter, of the School of Histology, who can certify to the general correctness of these figures.

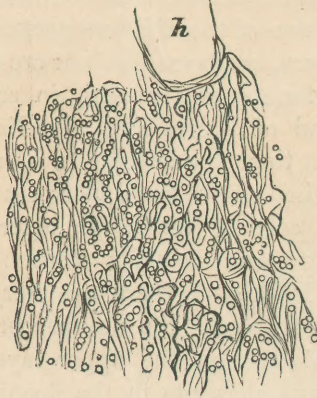
From a study of the sections the following observations were made as to the condition of the different parts of the skin. In Fig. 1 the epidermis, corium, and part of a hair are represented. In the corneous layer the fungus was present in some places in great amount. It consisted of spores and mycelia, the former being much more abundant than the latter. In some places it was most abundant between the cells of the uppermost layers, and at other places between the cells of the lower layers. Altogether the greatest number of fungus elements were between the cells of the upper layers. In Fig. 1 there are very few to be seen in the corneous layer. In reality the number present was very considerable, but in this section the upper layers of cells, as well as many of the fungus elements in the deeper layers, became detached by the manipulations with the section. The greatest number in the corneous layer was observed where this structure surrounds the hair, forming a part of the internal root sheath, that is, from the neck of the hair follicle to the free surface. In Fig. 1 the fungi are well shown in this situation, the internal root sheath being here in focus. It will be observed that nearly all of the fungus elements in this layer in Fig. 1 consist of spores, either isolated, grouped, or arranged in rows, but in some sections a considerable number of mycelial threads were present.

In the rete Malpighii both spores and mycelial threads were present. The spores were either isolated, grouped, or arranged in rows. There were rarely more than five or six spores in any group or row. They were generally present in greatest number in the upper part of the external root sheath. Their number did not always bear a direct relation to the number present in the corneous layer directly above them. Sometimes the corneous layer would contain a great number, and the rete beneath it would have only a few isolated spores, and *vice versa*. The mycelial threads were few in number and very short. Isolated spores are sometimes very difficult to detect in the rete. The section must not be deeply colored.

In the corium, spores were found in varying quantity. They were either isolated, grouped, or arranged in rows (see Fig. 1). The individual spores were either round or cylindrical. In some parts of the sections the fungi were absent. In Fig. 1, on the lower part of the left side, they were no longer to be observed.

In the subcutaneous tissue (see Fig. 2) spores were found in great number in the tissue surrounding an empty hair follicle (*h*).

FIG. 2.



Here they were as plentiful as in any part of the corneous layer. The specimen which showed them most distinctly, and in greatest number, was unfortunately destroyed by the covering glass. This specimen had previously been studied by Dr. Porter. In Fig. 2 the connective tissue is only partly represented. Here the spores were both round and cylindrical. A few cylindrical ones were of considerable thickness. Apart from this one place, but few spores were seen in the subcutaneous tissue.

Around the root of the hairs represented in Figs. 5 and 6 isolated spores were observed. In this patient the presence of the fungus in the rete and connective tissue produced but very slight inflammation. Only in the neighborhood of the empty hair follicle, as represented in Fig. 2, were there signs of an inflammatory process, and there the connective-tissue bundles were not destroyed.

In Fig. 3 I have represented the amount of fungus elements frequently observed in the free hair shaft near the skin. This piece of hair shaft was found among the epidermic cells, in another case of *tinea tonsurans capillitii* under my care. The effect of so much fungus is to completely destroy the integrity of the hair at that place.

In Fig. 4 is represented the effect sometimes produced upon a hair stump where fewer fungi are present. This drawing was made from a section of the excised skin, and shows changes very similar to those observed in Figs. 1 and 7. Spores and mycelial threads were



present in small quantity, and the hair shaft is seen to be divided up into more or less broad longitudinal fibers. The fibers show an occasional transverse fracture.

FIG. 3.

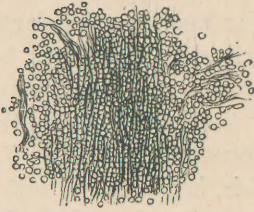
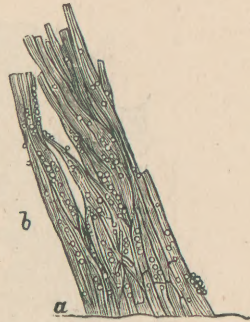


FIG. 4.



*a*, free surface of skin; *b*, hair stump.

Fungi were found in all parts of the hair situated within the skin, but the greatest number were present in that part situated above the neck of the follicle. I have observed them in the root of the hair. The effect upon the hair may be the bending mentioned

FIG. 5.



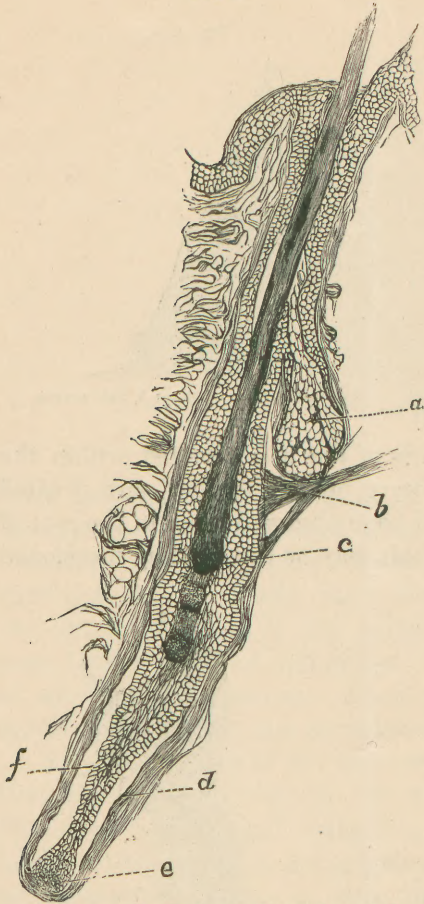
FIG. 6.



by Dr. Thin. (See Figs. 5 and 6.) The explanation given by Dr. Thin I believe is correct. In Fig. 6 spores were present in the

root of the hair. Here the internal follicle sheath is separated for some distance from the external root sheath. This hair was in

FIG. 7.



*a*, sebaceous gland; *b*, muscle; *c*, pigmented end of hair shaft; *d*, internal follicle sheath; *e*, root of hair; *f*, external root sheath.

process of being cast off. In Fig. 7 is represented a later stage of this same process. As the changes are the same as in the normal death of a hair, they need not be further described. There has been an interference with the nutrition of the hair roots in the hairs represented in Figs. 6 and 7. This, however, did not depend upon fungi within the hair follicle, as they were present in too small number to have produced such a result. I would attribute it to an interference with the nutrition of the whole skin at the seat of the disease. Spores were found in the duct of the sebaceous gland and in the free extremity of the sweat duct.

From these observations we would conclude that the anatomical seat of the fungus in *tinea tonsurans capillitii* is different in different cases of the disease. It may be seated only in the corneous layer and hair shaft, or it may extend even to the subcutaneous tissue.

Probably in those cases in which a large number of hairs fall out entire the fungus extends deeper than in those cases of only stubbed hairs. The deep seat of the fungus in some cases is probably the cause of the occasional obstinacy of the disease and difficulty of cure.





